AMTEST

AmTest Inc.

Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1664

SOURCE

EMISSION

EVALUATION

FEBRUARY 5, 1990

Prepared For:

BALL-INCON GLASS PACKAGING CORP.
SEATTLE PLANT
GLASS FURNACES #3, #4, AND #5
SEATTLE, WASHINGTON
DECEMBER 11-13, 1989

Submitted by:

Kris A. Hansen
Director - Air Quality Division

James A. Guenthoer
Sr. Project Engineer

K. Steven Mackey
Sr. Air Quality Specialist

Jan M. Widmeyer
Project Assistant

AM TEST, INC.
AIR QUALITY DIVISION
REDMOND, WASHINGTON

We certify that the information contained herein is accurate and complete to the best of our knowledge.

1. INTRODUCTION

The purpose of this source emission evaluation was to quantify emissions of particulate matter, hexavalent chromium (Cr^{+6}), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO) from three (3) sources at Ball-InCon Glass Packaging Corporation's (Ball-InCon) facility in Seattle, Washington. Ball-InCon's Muncie, Indiana office contracted Am Test, Inc.'s Air Quality Division of Redmond, Washington to perform a series of source tests for engineering purposes at Furnace #3, #4 and #5. Sampling was performed on December 11-13, 1989. Three (3) runs of each sample type were performed at each furnace.

Environmental Protection Agency (EPA) methods presented in the Title 40 Code of Federal Regulations, Part 60 (40 CFR 60), Appendix A were used for these tests. Methods 1 and 2 were performed to measure the stack gas temperature, velocity and volumetric flow rate. Method 3A was performed to determine the molecular weight of the stack gas and to measure the concentration of oxygen and carbon dioxide in the gas stream. Method 4 was performed to measure the moisture content of the stack gas. Method 5 was performed to quantify particulate matter and condensable hydrocarbon emissions. The Puget Sound Air Pollution Control Agency (PSAPCA) requires that the condensable particulate matter present in the gas stream be quantified by performing an extraction of the backhalf portion of the Method 5 sample train. The sample method used for hexavalent chromium is similar to EPA Method 5, but the sample train was modified to exclude the front-half filter and utilized 0.1 N sodium hydroxide (NaOH) solution in the impingers. A final back-half Teflon^R filter was connected in series to collect any hexavalent (Cr^{+6}) which was not absorbed in solution. Methods 6C, 7E, and 10 were used to measure emissions of sulfur dioxide, nitrogen oxides, and carbon monoxide (CO),

respectively. These methods utilize instrumental analyzers which analyze samples on a continuous basis and output the measurements to a data acquisition system. Measurements from the instruments were digitally recorded once per minute during each run. Method 6C measures the parts per million (ppm) SO_2 and utilizes a fluorescent analyzer. Method 7E measures the parts per million (ppm) NO_x as nitrogen dioxide (NO_2) and utilizes a chemiluminescent analyzer. Method 10 measures the ppm carbon monoxide (CO) and utilizes a non-dispersive infrared analyzer.

Mr. James A. Guenthoer, Mr. K. Steven Mackey and Ms. Jan M. Widmeyer of Am Test, Inc.'s Air Quality Division performed the field sampling and in-field sample recovery. Laboratory analysis, data reduction, and final report preparation was performed by Ms. Angela F. Blaisdell, Ms. Widmeyer and Mr. Kris A. Hansen of Am Test. Am Test, Inc.'s Water Chemistry Division performed hexavalent chromium analyses. This testing program was coordinated by Mr. Marvin C. Gridley of Ball-InCon. Mr. Gridley provided process operation data which is provided in Appendix B of this report. Mr. Fredrick L. Austin of the Puget Sound Air Pollution Control Agency (PSAPCA) observed the field testing.

2. SUMMARY OF RESULTS

The data presented in Table 2.1 summarizes the emission concentration results for each compound evaluated at each furnace exhaust. The data presented in Table 2.2 summarizes the mass emission rate results for each compound evaluated at each furnace exhaust. The particulate matter results for each furnace are also summarized on pages 5-7 in printouts titled "Method 1-5 - Summary of Results". The hexavalent chromium results for each furnace are also summarized on pages 8-10 in printouts titled "Methods 1-4 & Hexavalent Chromium - Summary of Results".

Table 2.1. Summary of emission test results collected at Ball-InCon Glass Packaging in Seattle, Washington on December 11-13, 1989.

Location Run #	Dilution Corrected Partic. Matter gr/dscf	Hex. Chromium ppm	Sulfur Dioxide ppm	Nitrogen Oxides ppm	Carbon Monoxide ppm
Furnace #3					
Run 1	0.071	0.002	19	510	<3
Run 2	0.065	0.001	34	496	<3
Run 3	0.072	0.001	44	501	<3
Average	0.069	0.001	32	502	<3
Furnace #4					
Run 1	0.065	0.002	14	867	<3
Run 2	0.066	0.004	14	898	<3
Run 3	0.047	0.007	13	859	<3
Average	0.059	0.004	14	875	<3
Furnace #5					
Run 1	0.103	0.008	8	914	<3
Run 2	0.112	0.004	9	950	<3
Run 3	0.117	<0.001	8	925	<3
Average	0.111	0.004	8	930	<3

115.2 #/T

129.6 #/T

127.4 #/T

The particulate matter emission concentration in Table 2.1 (corrected for dilution air) is presented in units of grains per dry standard cubic foot (gr/dscf). The gaseous emissions are presented in concentration units of parts per million (ppm). The sulfur dioxide and nitrogen oxides (as NO_2) sample times correspond to those of the Method 5 runs, with the exception of Furnace #4, runs 2 and 3, which correspond to the times when hexavalent chromium samples were being collected during runs 2 and 3 at Furnace #4.

Table 2.2. Summary of mass emissions from tests performed at Ball-InCon Glass Packaging in Seattle, Washington on December 11-13, 1989.

Location Run #	Partic. Matter lb/hr	Hex. Chromium mg/hr	Sulfur Dioxide lb/hr	Nitrogen Oxides lb/hr	Carbon Monoxide lb/hr
Furnace #3 115.2 tpd					
Run 1	5.14	145.1	3.79	73.1	<0.3
Run 2	4.74	97.6	6.78	71.1	<0.3
Run 3	5.63	61.6	9.01	73.8	<0.3
Average 1.08 #/T lb/ton	5.17 1.08	101.4	6.53 1.36	72.7 15.14	<0.3
Furnace #4 129.6 tpd					
Run 1	6.69	167.7	3.32	147.9	<0.3
Run 2	7.92	442.3	3.81	175.8	<0.3
Run 3	5.26	607.8	3.17	150.8	<0.3
Average 1.23 #/T lb/ton	6.62 1.23	405.9	3.43 .635	158.2 29.3	<0.3
Furnace #5 127.4 tpd					
Run 1	5.21	505.2	1.20	99.0	<0.3
Run 2	5.20	234.9	1.31	99.2	<0.3
Run 3	5.48	5.7	1.16	96.5	<0.3
Average 1.00 #/T	5.30 1.00	248.6	1.22 .23	98.2 18.5	<0.3

Tonnage 115 Tons/day

Tonnage 129.6

Tonnage 127.4

The mass emission rates of particulate matter, sulfur dioxide, nitrogen oxides (as NO_2), and carbon monoxide are presented in pounds per hour (lb/hr). The mass emission rate of hexavalent chromium is presented in units of milligrams per hour (mg/hr). Computer printouts of the results from these tests are included in Appendix A of this report.

METHOD 1-5 - SUMMARY OF RESULTS
AM TEST, INC. - AIR QUALITY DIVISION

FILE NAME: PM#3SUM
CLIENT: BALL-INCON
LOCATION: SEATTLE, WASHINGTON
SAMPLE SITE: #3 FURNACE STACK
OPERATORS: J. GUENTHOER
CONTACT: M. GRIDLEY

	RUN #1	RUN #2	RUN #3	AVERAGE
LAB #:	923709	923710	923711	
DATE:	12/11	12/11	12/11	
START TIME:	15:20	16:46	18:35	
STOP TIME:	16:20	17:46	19:35	
SAMPLE TIME (Minutes):	60.0	60.0	60.0	
VOLUME SAMPLED (Cubic Feet):	46.774	47.342	48.827	47.648
VOLUME SAMPLED (Dry Std. Cubic Feet):	48.987	49.767	51.435	50.063
VOLUME SAMPLED (Dry Std. Cubic Meters):	1.387	1.409	1.457	1.418
STACK GAS MOISTURE (Percent):	4.22	4.25	4.33	4.27
BAROMETRIC PRESURE (Inches of Hg):	30.65	30.65	30.65	30.65
STATIC PRESSURE (Inches of H2O):	-0.30	-0.30	-0.30	-0.30
STACK PRESSURE (Inches of Hg):	30.63	30.63	30.63	30.63
STACK TEMPERATURE (Degrees F.):	336.1	335.7	330.1	334.0
STACK TEMPERATURE (Degrees R.):	796.1	795.7	790.1	794.0
CARBON DIOXIDE (Percent):	2.2	2.6	2.5	2.4
OXYGEN (Percent):	17.3	17.2	17.2	17.2
CARBON MONOXIDE (ppm):	0	0	0	0
MOLECULAR WEIGHT (Dry, Lb/Lb-Mole):	29.04	29.10	29.09	29.08
MOLECULAR WEIGHT (Wet, Lb/Lb-Mole):	28.58	28.63	28.61	28.61
AVERAGE VELOCITY HEAD (Inches of H2O):	0.327	0.328	0.344	0.333
PITOT TUBE Cp:	0.840	0.840	0.840	
VELOCITY (Feet/Second):	39.15	39.15	39.97	39.42
STACK DIAMETER (Inches):	49.00	49.00	49.00	
STACK AREA (Square Feet):	13.095	13.095	13.095	
AIRFLOW (Dry Std. Cubic Feet per Min.):	20003.2	20007.3	20555.7	20188.7
DILUTION AIRFLOW (dscf/min):	11538.2	11531.0	11431.6	11500.3
AIRFLOW (Actual Cubic Feet per Min.):	30761.2	30761.8	31408.9	30977.3
NOZZLE DIAMETER (Inches):	0.313	0.313	0.313	
ISOKINETICS (Percent):	100	102	102	101
PARTIC. EMISS. CONC. (FRONTHALF-gr/dscf)	0.028	0.028	0.030	0.029
PARTIC. EMISS. CONC. (BACKHALF-gr/dscf):	0.002	0.000	0.002	0.001
PARTIC. EMISS. CONC. (TOTAL-gr/dscf):	0.030	0.028	0.032	0.030
DILUTION CORRECTED P.M. CONC. (gr/dscf):	0.071	0.065	0.072	0.069
PARTIC. EMISS. CONC. (TOTAL-mg/dscm):	68.6	63.3	73.2	68.4
MASS EMISSION RATE (lb/hr):	5.14	4.74	5.63	5.17
Opacity	0.0	0.1	0.3	

METHOD 1-5 - SUMMARY OF RESULTS
AM TEST, INC. - AIR QUALITY DIVISION

FILE NAME:	PM#4SUM
CLIENT:	BALL-INCON
LOCATION:	SEATTLE, WASHINGTON
SAMPLE SITE:	#4 FURNACE STACK
OPERATORS:	J. GUENTHOER
CONTACT:	M. GRIDLEY

	RUN #1	RUN #2	RUN #3	AVERAGE
LAB #:	923715	923716	923717	
DATE:	12/13	12/13	12/13	
START TIME:	13:35	15:05	16:23	
STOP TIME:	14:35	16:05	17:23	
SAMPLE TIME (Minutes):	60.0	60.0	60.0	
VOLUME SAMPLED (Cubic Feet):	51.914	53.826	52.100	52.613
VOLUME SAMPLED (Dry Std. Cubic Feet):	52.614	55.416	53.005	53.678
VOLUME SAMPLED (Dry Std. Cubic Meters):	1.490	1.569	1.501	1.520
STACK GAS MOISTURE (Percent):	5.62	5.52	5.48	5.54
BAROMETRIC PRESURE (Inches of Hg):	30.55	30.52	30.52	30.53
STATIC PRESSURE (Inches of H2O):	-1.30	-1.30	-1.30	-1.30
STACK PRESSURE (Inches of Hg):	30.45	30.42	30.42	30.43
STACK TEMPERATURE (Degrees F.):	579.8	560.6	588.9	576.4
STACK TEMPERATURE (Degrees R.):	1039.8	1020.6	1048.9	1036.4
CARBON DIOXIDE (Percent):	3.9	3.9	3.8	3.9
OXYGEN (Percent):	15.6	15.4	15.4	15.5
CARBON MONOXIDE (ppm):	0	0	0	0
MOLECULAR WEIGHT (Dry, Lb/Lb-Mole):	29.25	29.24	29.22	29.24
MOLECULAR WEIGHT (Wet, Lb/Lb-Mole):	28.62	28.62	28.61	28.62
AVERAGE VELOCITY HEAD (Inches of H2O):	1.219	1.358	1.280	1.286
PITOT TUBE Cp:	0.840	0.840	0.840	
VELOCITY (Feet/Second):	86.62	90.60	89.21	88.81
STACK DIAMETER (Inches):	41.50	41.50	41.50	
STACK AREA (Square Feet):	9.393	9.393	9.393	
AIRFLOW (Dry Std. Cubic Feet per Min.):	23814.2	25378.6	24324.1	24505.6
DILUTION AIRFLOW (dscf/min):	11850.2	11343.3	11298.8	11497.4
AIRFLOW (Actual Cubic Feet per Min.):	48818.2	51061.7	50276.9	50052.3
NOZZLE DIAMETER (Inches):	0.254	0.254	0.254	
ISOKINETICS (Percent):	98	97	97	97
PARTIC. EMISS. CONC. (FRONTHALF-gr/dscf)	0.022	0.022	0.022	0.022
PARTIC. EMISS. CONC. (BACKHALF-gr/dscf):	0.011	0.014	0.003	0.009
PARTIC. EMISS. CONC. (TOTAL-gr/dscf):	0.033	0.036	0.025	0.031
DILUTION CORRECTED P.M. CONC. (gr/dscf):	0.065	0.066	0.047	0.059
PARTIC. EMISS. CONC. (TOTAL-mg/dscm):	75.0	83.3	57.7	72.0
MASS EMISSION RATE (lb/hr):	6.69	7.92	5.26	6.62
2 family	0.3	0.6	0.3	

METHOD 1-5 - SUMMARY OF RESULTS
AM TEST, INC. - AIR QUALITY DIVISION

FILE NAME:	PM#5SUM
CLIENT:	BALL-INCON
LOCATION:	SEATTLE, WASHINGTON
SAMPLE SITE:	#5 FURNACE STACK
OPERATORS:	J. GUENTHOER
CONTACT:	M. GRIDLEY

	RUN #1	RUN #2	RUN #3	AVERAGE
LAB #:	923712	923713	923714	
DATE:	12/12	12/12	12/12	
START TIME:	15:30	17:05	18:31	
STOP TIME:	16:30	18:05	19:31	
SAMPLE TIME (Minutes):	60.0	60.0	60.0	
VOLUME SAMPLED (Cubic Feet):	50.179	48.149	47.878	48.735
VOLUME SAMPLED (Dry Std. Cubic Feet):	51.259	49.429	49.074	49.921
VOLUME SAMPLED (Dry Std. Cubic Meters):	1.452	1.400	1.390	1.414
STACK GAS MOISTURE (Percent):	6.43	6.62	6.50	6.52
BAROMETRIC PRESURE (Inches of Hg):	30.55	30.55	30.55	30.55
STATIC PRESSURE (Inches of H2O):	-0.35	-0.35	-0.35	-0.35
STACK PRESSURE (Inches of Hg):	30.52	30.52	30.52	30.52
STACK TEMPERATURE (Degrees F.):	663.8	657.1	662.0	661.0
STACK TEMPERATURE (Degrees R.):	1123.8	1117.1	1122.0	1121.0
CARBON DIOXIDE (Percent):	3.7	4.1	4.0	3.9
OXYGEN (Percent):	15.3	15.2	15.3	15.3
CARBON MONOXIDE (ppm):	1	0	0	0.33
MOLECULAR WEIGHT (Dry, Lb/Lb-Mole):	29.20	29.26	29.25	29.24
MOLECULAR WEIGHT (Wet, Lb/Lb-Mole):	28.48	28.52	28.52	28.51
AVERAGE VELOCITY HEAD (Inches of H2O):	0.537	0.499	0.499	0.512
PITOT TUBE Cp:	0.840	0.840	0.840	
VELOCITY (Feet/Second):	59.83	57.45	57.57	58.28
STACK DIAMETER (Inches):	41.50	41.50	41.50	
STACK AREA (Square Feet):	9.393	9.393	9.393	
AIRFLOW (Dry Std. Cubic Feet per Min.):	15122.2	14581.0	14567.1	14756.8
DILUTION AIRFLOW (dscf/min):	9204.5	9167.1	9087.8	9153.1
AIRFLOW (Actual Cubic Feet per Min.):	33718.0	32380.8	32449.6	32849.5
NOZZLE DIAMETER (Inches):	0.313	0.313	0.313	
ISOKINETICS (Percent):	99	99	99	99
PARTIC. EMISS. CONC. (FRONTHALF-gr/dscf)	0.035	0.035	0.037	0.036
PARTIC. EMISS. CONC. (BACKHALF-gr/dscf):	0.005	0.007	0.007	0.006
PARTIC. EMISS. CONC. (TOTAL-gr/dscf):	0.040	0.042	0.044	0.042
DILUTION CORRECTED P.M. CONC. (gr/dscf):	0.103	0.112	0.117	0.111
PARTIC. EMISS. CONC. (TOTAL-mg/dscm):	92.0	95.3	100.4	95.9
MASS EMISSION RATE (lb/hr):	5.21	5.20	5.48	5.30
Opacity	0,2	0,4	0,3	

METHODS 1-4 & HEXAVALENT CHROMIUM - SUMMARY OF RESULTS
AM TEST, INC. - AIR QUALITY DIVISION

FILE NAME: BICR3SUM
CLIENT: BALL-INCON GLASS PACKAGING CORP.
LOCATION: SEATTLE, WASHINGTON
SAMPLE SITE: #3 FURNACE STACK
OPERATORS: J. GUENTHOER
CONTACT: M. GRIDLEY

	RUN #1	RUN #2	RUN #3	AVERAGE
LAB #:	922680	922682	922684	
DATE:	12/11	12/11	12/11	
START TIME:	10:49	12:20	13:50	
STOP TIME:	11:49	13:20	14:50	
SAMPLE TIME (Minutes):	60.0	60.0	60.0	
VOLUME SAMPLED (Cubic Feet):	31.413	47.383	47.280	42.025
VOLUME SAMPLED (Dry Std. Cubic Feet):	33.244	49.513	49.137	43.965
VOLUME SAMPLED (Dry Std. Cubic Meters):	0.941	1.402	1.392	1.245
STACK GAS MOISTURE (Percent):	7.30	6.17	4.51	5.99
BAROMETRIC PRESURE (Inches of Hg):	30.35	30.35	30.31	30.34
STATIC PRESSURE (Inches of H2O):	-0.30	-0.30	-0.30	-0.30
STACK PRESSURE (Inches of Hg):	30.33	30.33	30.29	30.32
STACK TEMPERATURE (Degrees F.):	327.2	325.8	325.8	326.3
STACK TEMPERATURE (Degrees R.):	787.2	785.8	785.8	786.3
CARBON DIOXIDE (Percent):	2.0	2.4	2.9	2.4
OXYGEN (Percent):	16.5	17.3	17.3	17.0
CARBON MONOXIDE (Percent):	0	0	0	0
MOLECULAR WEIGHT (Dry, Lb/Lb-Mole):	28.98	29.08	29.16	29.07
MOLECULAR WEIGHT (Wet, Lb/Lb-Mole):	28.18	28.39	28.65	28.41
AVERAGE VELOCITY HEAD (Inches of H2O):	0.347	0.342	0.335	0.341
PITOT TUBE Cp:	0.840	0.840	0.840	
VELOCITY (Feet/Second):	40.58	40.12	39.54	40.08
STACK DIAMETER (Inches):	49.00	49.00	49.00	
STACK AREA (Square Feet):	13.095	13.095	13.095	
AIRFLOW (Dry Std. Cubic Feet per Min.):	20097.7	20142.7	20176.4	20138.9
AIRFLOW (Actual Cubic Feet per Min.):	31886.4	31521.9	31064.7	31491.0
NOZZLE DIAMETER (Inches):	0.254	0.313	0.313	
ISOKINETICS (Percent):	103	100	100	101
HEXAVALENT CHROMIUM CONC. (mg/dscm):	0.004	0.003	0.002	0.003
TOTAL HEX. CHROMIUM IN SAMPLE (ppm):	0.002	0.001	0.001	0.001
HEX. CHROMIUM EMISSION RATE (mg/hr):	145.1	97.6	61.6	101.4

METHODS 1-4 & HEXAVALENT CHROMIUM - SUMMARY OF RESULTS
AM TEST, INC. - AIR QUALITY DIVISION

FILE NAME:	BICR4SUM
CLIENT:	BALL-INCON GLASS PACKAGING CORP.
LOCATION:	SEATTLE, WASHINGTON
SAMPLE SITE:	#4 FURNACE STACK
OPERATORS:	J. GUENTHOER
CONTACT:	M. GRIDLEY

	RUN #1	RUN #2	RUN #3	AVERAGE
LAB #:	923140	923142	923144	
DATE:	12/13	12/13	12/13	
START TIME:	09:08	10:39	12:08	
STOP TIME:	10:08	11:39	13:08	
SAMPLE TIME (Minutes):	60.0	60.0	60.0	
VOLUME SAMPLED (Cubic Feet):	53.897	58.357	52.757	55.004
VOLUME SAMPLED (Dry Std. Cubic Feet):	55.709	59.292	53.200	56.067
VOLUME SAMPLED (Dry Std. Cubic Meters):	1.578	1.679	1.507	1.588
STACK GAS MOISTURE (Percent):	6.89	5.17	5.48	5.85
BAROMETRIC PRESURE (Inches of Hg):	30.55	30.55	30.55	30.55
STATIC PRESSURE (Inches of H2O):	-1.30	-1.30	-1.30	-1.30
STACK PRESSURE (Inches of Hg):	30.45	30.45	30.45	30.45
STACK TEMPERATURE (Degrees F.):	573.8	565.3	576.8	572.0
STACK TEMPERATURE (Degrees R.):	1033.8	1025.3	1036.8	1032.0
CARBON DIOXIDE (Percent):	3.6	3.8	3.3	3.6
OXYGEN (Percent):	15.6	15.6	15.5	15.6
CARBON MONOXIDE (Percent):	0	0	0	0
MOLECULAR WEIGHT (Dry, Lb/Lb-Mole):	29.20	29.23	29.15	29.19
MOLECULAR WEIGHT (Wet, Lb/Lb-Mole):	28.43	28.65	28.54	28.54
AVERAGE VELOCITY HEAD (Inches of H2O):	1.422	1.570	1.280	1.424
PITOT TUBE Cp:	0.840	0.840	0.840	
VELOCITY (Feet/Second):	93.56	97.54	88.74	93.28
STACK DIAMETER (Inches):	41.50	41.50	41.50	
STACK AREA (Square Feet):	9.393	9.393	9.393	
AIRFLOW (Dry Std. Cubic Feet per Min.):	25525.6	27326.5	24505.0	25785.7
AIRFLOW (Actual Cubic Feet per Min.):	52730.7	54974.8	50012.4	52572.6
NOZZLE DIAMETER (Inches):	0.254	0.254	0.254	
ISOKINETICS (Percent):	97	97	97	97
HEXAVALENT CHROMIUM CONC. (mg/dscm):	0.004	0.010	0.015	0.010
TOTAL HEX. CHROMIUM IN SAMPLE (ppm):	0.002	0.004	0.007	0.004
HEX. CHROMIUM EMISSION RATE (mg/hr):	167.7	442.3	607.8	405.9

METHODS 1-4 & HEXAVALENT CHROMIUM - SUMMARY OF RESULTS
AM TEST, INC. - AIR QUALITY DIVISION

FILE NAME: BICR5SUM
CLIENT: BALL-INCON GLASS PACKAGING CORP.
LOCATION: SEATTLE, WASHINGTON
SAMPLE SITE: #5 FURNACE STACK
OPERATORS: J. GUENTHOER
CONTACT: M. GRIDLEY

	RUN #1	RUN #2	RUN #3	AVERAGE
LAB #:	922807	922809	922811	
DATE:	12/12	12/12	12/12	
START TIME:	11:08	12:40	14:05	
STOP TIME:	12:08	13:40	15:05	
SAMPLE TIME (Minutes):	60.0	60.0	60.0	
VOLUME SAMPLED (Cubic Feet):	52.997	52.734	51.564	52.432
VOLUME SAMPLED (Dry Std. Cubic Feet):	54.841	54.456	53.048	54.115
VOLUME SAMPLED (Dry Std. Cubic Meters):	1.553	1.542	1.502	1.532
STACK GAS MOISTURE (Percent):	6.07	6.27	6.58	6.31
BAROMETRIC PRESURE (Inches of Hg):	30.59	30.59	30.55	30.58
STATIC PRESSURE (Inches of H2O):	-0.35	-0.35	-0.35	-0.35
STACK PRESSURE (Inches of Hg):	30.56	30.56	30.52	30.55
STACK TEMPERATURE (Degrees F.):	622.6	669.8	674.4	655.6
STACK TEMPERATURE (Degrees R.):	1082.6	1129.8	1134.4	1115.6
CARBON DIOXIDE (Percent):	3.4	3.7	3.7	3.6
OXYGEN (Percent):	15.8	15.5	15.5	15.6
CARBON MONOXIDE (ppm):	0	0	0	0
MOLECULAR WEIGHT (Dry, Lb/Lb-Mole):	29.18	29.21	29.21	29.20
MOLECULAR WEIGHT (Wet, Lb/Lb-Mole):	28.50	28.51	28.47	28.49
AVERAGE VELOCITY HEAD (Inches of H2O):	0.610	0.633	0.583	0.609
PITOT TUBE Cp:	0.840	0.840	0.840	
VELOCITY (Feet/Second):	62.54	65.05	62.67	63.42
STACK DIAMETER (Inches):	41.50	41.50	41.50	
STACK AREA (Square Feet):	9.393	9.393	9.393	
AIRFLOW (Dry Std. Cubic Feet per Min.):	16497.1	16406.8	15668.0	16190.6
AIRFLOW (Actual Cubic Feet per Min.):	35249.8	36662.5	35319.5	35743.9
NOZZLE DIAMETER (Inches):	0.313	0.313	0.313	
ISOKINETICS (Percent):	97	97	99	98
HEXAVALENT CHROMIUM CONC. (mg/dscm):	0.018	0.008	0.000	0.009
TOTAL HEX. CHROMIUM IN SAMPLE (ppm):	0.008	0.004	0.000	0.004
HEX. CHROMIUM EMISSION RATE (mg/hr):	505.2	234.9	5.7	248.6

Ball-InCon
Glass Packaging Corp.
1509 South Macedonia Avenue
Muncie, IN 47302-3664
(317) 741-7000

Reply to: P.O. Box 4200
Muncie, IN 47307-4200

Ball-InCon

December 21, 1989

AmTEST, Inc.
14603 N.E. 87th Street
Redmond, WA 98052

Attn: Kris Hansen

Dear Kris,

Attached are furnace operating data sheets and summary opacity meter records for the three glass melting furnaces tested at our Seattle plant last week. These should be included as part of the final test reports we will submit to PSAPCA. I wanted to confirm with Jim Nolan of PSAPCA that the appropriate data was included before sending it to you.

The testing went well on all three furnaces. I wanted you to know that the test team of Jan Widmeyer, Jim Guenthoer and Steve Mackey did an excellent job. They arrived early, stayed late (six runs each day) and were prepared and professional at all times. When we test again later next year, I'd like to have them back.

I'd be interested in preliminary results on the particulate runs as soon as you have them. Give me a call if you need any other information for the report.

Sincerely,

MC Gridley

Marvin C. Gridley
Project Engineer

cc: D. N. Coburn
F. W. Glinka
G. E. Hughes
P. A. Hummel

OPERATING DATA #3 FURNACE DEC. 11, 1989 11:30AM
COLOR - CHANPAGNE GREEN
TOTAL TONS/24 HOURS - 115.2

#31 SHOP - JOB NO. 7510 - 750 ml/ WINE - 50.3 TONS
#32 SHOP - JOB NO. 7510 - 750 ml/ WINE - 64.9 TONS

CULLET USED 23% BY BATCH WEIGHT

GAS - 18,750 CUBIC FT./HOUR
AIR - 262000 CUBIC FT./HOUR
ELECTRIC - 1067 KW
BRIDGEWALL TEMP. 2826°F

BATCH FORMULA

SAND	3158	lbs	
SODA ASH	919	lbs	
LIMESTONE	829	lbs	
SALTCAKE	25	lbs	
NICKEL OXIDE	6	lbs	4 oz.
COBALT OXIDE			2 oz.
IRON CHROMITE	13	lbs	
CARBOCITE	1	lb	
TOTAL	4951	lbs	6 oz.

OPERATING DATA #4 FURNACE DEC. 13, 1939
COLOR - FLINT
129.6 TONS / 24 HOURS

41 SHOP JOB 9467 59.9 TONS
42 SHOP JOB 7517 69.7 TONS

GAS - 27000 ft.³/HOUR
AIR - 335600 ft.³/HOUR
ELECTRIC - 1097 KW
BRIDGEWALL TEMP. 2780°
CULLET - 20.2% BY BATCH WT.

O_2 NORTH SIDE 7.5%
SOUTH SIDE 8.0%

BATCH FORMULA

L.M. SAND	2327 lbs	
EMMETT SAND	787 lbs	
SODA ASH	955 lbs	
LIMESTONE	820 lbs	
SALTCAKE	29 lbs	6 oz.
CARBOCITE	1 lb	10 oz.
SELENIUM		1 oz.
POWDER BLUE		3 oz.
	4920 lbs	4 oz.

OPERATING DATA #5 FURNACE DEC. 12, 1989

COLOR - AMBER

TOTAL TONS / 24 HOURS = 127.4

#51 SHOP - JOB NO. 9666 - 66.6 TONS

52 SHOP - JOB NO. 9636 - 60.8

Cullet used 45% By BATCH weight

GAS - 30,000 CUBIC FT. / HOUR

AIR 375,000 CUBIC FT. / HOUR

Electric - 1104 KW

BRIDGEWALL TEMP. 2790° F

O_2 WEST SIDE 6.5%

EAST SIDE 7.0%

BATCH FORMULA

SAND	3158 lbs	
SODA ASH	919 lbs	
LIMESTONE	829 lbs	
IRON PYRITE	8 lbs	8 oz.
CARBOCITE	7 lbs	8 oz.
	4922 lbs.	